An Interdisciplinary Approach to Understanding the Climate Science Needs of Natural Resource Managers in the Prairie Pothole Region (PPR)

Heather M. Yocum (CIRES) **and Andrea J. Ray** (NOAA Earth Systems Research Laboratory)
Boulder Laboratories Postdoctoral Poster Symposium -- June 18, 2014

Interdisciplinary teams

In order for climate science to be useful and usable, natural resource managers and policymakers must be able to access, interpret, and apply climate knowledge. Interdisciplinary teams draw on the strengths of the physical and social sciences to generate applicable climate knowledge that meets the needs of a broad range of decision-makers.

Our interdisciplinary team includes:

- A team of climate scientists lead by Richard Seager (Lamont-Doherty Earth Observatory)
- Hydrologists Balaji Rajagopalan and Srijita Jana (CIRES)
- Geographer and applications scientist Andrea Ray (NOAA)
- Environmental anthropologist Heather Yocum (CIRES)

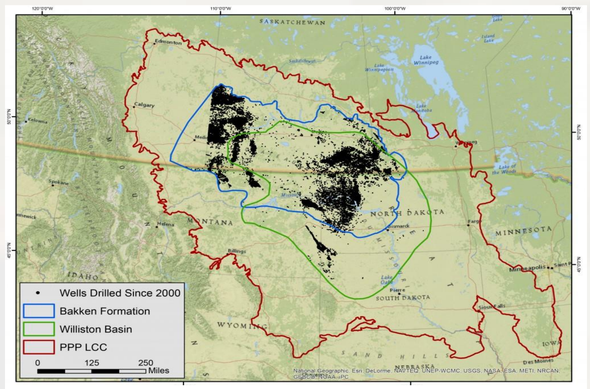
As part of a larger NSF-funded Earth System Modeling grant, we are investigating climate processes that shape ecoregions in Western North America; the predictability of those processes on decadal and longer time scales; and the interaction of climate with land, ecosystem, and water management. Stakeholder-focused applications studies will include:

(1) analyzing policy and management decisions to identify management needs; and
(2) translating climate science into applications by identifying the needs of natural resource managers.

In particular, we will be looking at the policy and management decisions related to the continued wetter conditions in the northern Great Plains, and whether to adapt to a wetter climate or anticipate a return to drier conditions.

Relevant stakeholders

- Plains and Prairie Potholes Landscape Conservation Cooperative (under the US Fish and Wildlife Service)
- Local, state, and federal natural resource management agencies
- Local and state policy makers
- Private landowners
- Community, non-profit, and non-governmental organizations (e.g. Ranchers grazing assoc., Ducks Unlimited, WWF, TNC)
- Oil and natural gas development sector



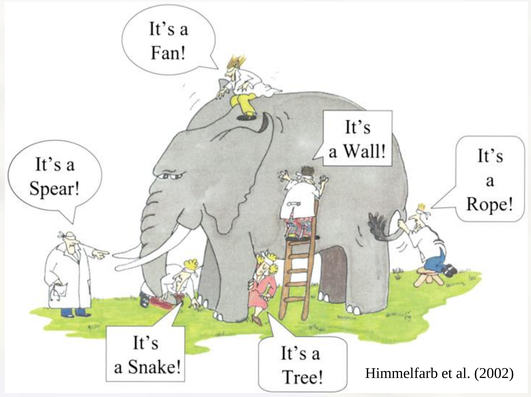
Map outlining the geography associated with the Plains and Prairie Pothole Region, Williston Basin, Bakken Formation, and all petroleum related wells drilled since 2000 (data for Alberta is not available). (Rashford, Schrag, and Walker 2013)

Why interdisciplinary?

The blind men and the elephant: Each discipline has a unique contribution that tells part of the story. Multiple points of view generate a more holistic picture of complex issues.

What can anthropology contribute to a climate project?

- Anthropology is "the most humanist of the sciences and the most scientific of the humanities" (Wolf 1964: 88)
- Moves beyond stakeholder consultation
- Uses social analysis to expand on research questions
- Expands the types of information and feedback we receive (provides the "how" and "why" in addition to the "what")



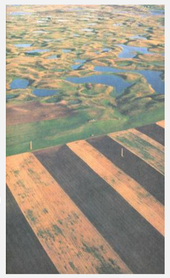
Himmelfarb et al. (2002)

	Anthropological concept	As applied to this research
General approaches to research questions	Holistic	• Interdisciplinary
	Importance of culture in social systems	• Institutional culture • Organizational culture • Regional and local culture
	Grounded theory	• Iterative research design • Inductive approach
Anthropological and social theories useful for initial study design and interpretation of results	Production of knowledge	• Different systems of knowing and assigning value
	Science and technology studies	• Process through which climate knowledge is produced • Access to climate knowledge
	Power, agency, structure, and practice	• Social networks, knowledge brokers, and information flows • Power relations between stakeholders
Specific processes and methods	Interviews and oral histories	• Individual and group interviews • Focus groups
	Participant observation	• Site visits and field research • Attending meetings and workshops
	Text and discourse analysis	• Climate models and projections • Reports and official documents
	Emic and etic (insider/outsider) perspectives	• Climate knowledge producers and climate science users

Adapted from Copeland-Carson 2005

Research context





Facts about the Plains and Prairie Pothole Region (PPR):

Climate and Land Use
- climatic and economic incentives for expanding agriculture
- warm and wet cycle – climate change or natural variability? (Ballard et al. *in review*)

Oil and Natural Gas Development in North Dakota
- #2 oil-producing state with 46,000 wells drilled since 2000 (Plains and Prairie Potholes LCC 2013)
- lowest unemployment rate, fastest population growth, and fastest growing economy in the US (Helms 2014)
- 14% of wells drilled since 2005 are on wetland or grassland easements (Helms 2014)

Conservation and Wildlife in the PPR
- breeding area for 50-80% of the ducks in North America (Batt et al. 1989; Johnson et al. 2005)
- $6.1 billion in cuts for conservation programs in the 2014 Farm Bill (National Sustainable Agriculture Coalition 2014)

(photos credit: the PPR LCC and the Montana State Gov't)

Enhancing our research questions with social analysis

- What climate knowledge are natural resource managers and decision-makers currently accessing? What information do they need?
  - How do users decide where to source climate information? Based on most current science, or on institutional and social connections?
  - Political affiliation
  - Coded language (e.g. rainfall instead of climate change)
  - Access pathways
- How and when is climate science used during decision-making processes?
  - Different time horizons for planning (e.g. creating 10-year State Wildlife Action Plans or determining annual water flows)
- How do different state and federal management institutions and individual land owners leverage climate knowledge in decision-making processes?
  - Importance of climate compared to economics or wildlife conservation
  - How tradeoffs differ amongst actors
  - Does the type of climate knowledge matter? If so, how?
- What gaps exist in the current useable climate science for the PPR? What information do users want that they don't already have?
  - Technical capacity and state of the science
  - Access pathways
  - Different perspectives on what counts as useable science
- How can climate science best address those gaps?
  - Organizational and technological capacity
  - One-way vs. reciprocal information flows
  - Input when defining research questions

Acknowledgements

- The National Science Foundation
- NOAA, CU, and CIRES
- The WestClim interdisciplinary research team, including Richard Seager, Andrea Ray, Balaji Rajagopalan, Mingfang Ting, Michela Biasutti, Jason Smerdon, Benjamin Cook, Naomi Henderson, Yochanan Kushnir, Arthur Greene, Donna Lee, and Haibo Liu
- Rick Nelson and the Plains and Prairie Potholes LCC
- North Central Climate Science Center

References

- Ballard, T. et al. *in review*. "Hydroclimate Variability and Change in the Prairie Pothole Regions, the 'Duck Factory' of North America." *Earth Observations.*
- Batt, B.D., et al. 1989. "The Use of Prairie Wetlands by North American Ducks." In *Northern Prairie Wetlands*, edited by A. van der Velk, 204–7. Ames, Iowa: Iowa State University Press.
- Copeland-Carson, J. 2005. "Applying Theory and Method in Evaluation Anthropology." *NAPA Bulletin* 24 (1): 89–106.
- Helms, L. 2014. "Current and Future Oil and Natural Gas Production in North Dakota." At The Wildlife Society North Dakota Chapter Meeting. Feb. 12, 2014. Mandan, ND.
- Himmelfarb, J. et al. 2002. "The Elephant in Uremia: Oxidant Stress as a Unifying Concept of Cardiovascular Disease in Uremia." *Kidney International* 62 (5): 1524–38.
- Johnson, W.C. et al. 2005. "Vulnerability of Northern Prairie Wetlands to Climate Change." *BioScience* 55 (10): 863–72.
- National Sustainable Agriculture Coalition. 2014. "2014 Farm Bill Drill Down: The Bill by the Numbers." http://sustainableagriculture.net/blog/2014-farm-bill-by-numbers/.
- Plains and Prairie Potholes LCC. 2013. "New Study Examines Relationship between Oil Production and Invasive Plant Species within the Williston Basin."
- Rashford, B. et al. 2013. "Targeting Grassland Conservation: An Estimate of Land-Use Conversion Risk in the Northern Great Plains". DU, Univ. of Wyoming, and WWF.
- Wolf, E.R. 1974. *Anthropology*. New York: W. W. Norton & Company.